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# TECHNICAL MEMORANDUM

## Utah Coal Regulatory Program

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February 14, 2011

TO: Internal File

THRU: Steve Christensen, Lead *SKC*

FROM: Kevin Lundmark, Environmental Scientist II *KL*

RE: Division Order 10A Response, Genwal Resources, Inc., Crandall Canyon Mines, C0150032 Task ID Nos. 3714 and 3724

### SUMMARY:

Genwal Resources, Inc. (Genwal) is currently operating a water treatment system at the Crandall Canyon Mine to reduce the concentration of iron in the mine water being discharged to Crandall Creek under UPDES Permit No. UT0024368. A permit amendment describing a mine water treatment system (MRP Appendix 7-65) was approved by the Division on January 27, 2010 (Task ID# 3461). At that time, the mine water treatment system included only a mechanical oxidation unit and a settling basin, although system modifications (e.g., the use of treatment chemicals) were contemplated in the amendment. The treatment system as initially designed and constructed was not effective at reducing iron concentrations in the mine water discharge to below the UPDES criterion of 1 mg/L (total) iron. Genwal has since modified the treatment system on a trial and error basis by adding unit operations not described in the MRP.

In July 2010, Genwal requested to discharge a sludge-water mixture from the mine water treatment system sedimentation basin to the Crandall Canyon sediment pond on a temporary basis to facilitate experimentation with sludge dewatering technologies. The following commitments (hereafter referred to as Commitment Numbers 1 through 5) were added to the MRP in July 2010 in association with Task ID# 3582 - Temporary Iron Sludge Storage:

*Following the termination of the clean out testing period (ending October 30, 2010), the following revisions to Appendix 7-65, Mine Discharge Water Iron Treatment Facility, will be submitted to the Division of Oil, Gas and Mining by November 30, 2010:*

- 1. Deletion of any previously approved language, discussion or attachment that is no longer relevant or applicable based upon current conditions.*
- 2. Revisions that reflect the design, as-built construction, operation, clean out and maintenance aspects of the Mine Discharge Water Iron Treatment System.*

3. *A summary/chronology of the experimental process that led to the final design including:*
  - *A summary of the various treatment methods that were examined/tested.*
  - *A discussion as to the chemical additives that were employed during the trial and error process. The discussion shall include the ratios of chemicals that were utilized in the various test configurations as well as the corresponding water quality results.*
  - *An up to date tabulation of the mine-water flow data that has been collected since the installation of the AVF Flow Meter*
  - *The field data and lab analytical results that were obtained during the various test configurations/water treatment approaches that were explored.*
4. *A discussion of iron sludge disposal options as contingency in the event that the Wildcat Loadout facility is no longer available to receive the material.*
5. *An up to date summary of the operational costs for the operational water treatment system configuration including: chemical costs, labor costs, maintenance costs, clean-out costs and equipment repair/replacement costs.*

Commitment Numbers 2 and 5 describe information which is also required from Genwal under Item IV.1. of Division Order (DO) 10A. On August 16, 2010, DO-10A was issued ordering Genwal resolve permit deficiencies by complying with the following five items:

- I. *Commencing immediately:*  
*Conduct monitoring on the chemistry and flow of the mine-water discharge.*
- II. *By August 31, 2010:*  
*Amend the MRP to reflect the required additional water monitoring and data collection required under item I.*
- III. *By October 16, 2010:*  
*Provide a bond or establish a trust fund or other funding instrument acceptable to the Division that will yield a yearly payment sufficient to cover mine-water treatment costs in perpetuity*
- IV. *By October 31, 2010:*
  1. *Amend the MRP to reflect the current operations, especially the "operational" treatment measures and facilities associated with the ongoing mine-water discharge, including all aspects of the treatment process with associated costs (capital, operations, maintenance) and as-built drawings.*

2. *Revise the Probable Hydrologic Consequences (PHC) determination in the MRP to reflect current conditions for the Crandall Canyon Mine. The new PHC must address the impact to water quantity and quality and aquatic habitat. It must also include water-monitoring recommendations, and describe how water-monitoring data will be used.*

*V. By March 31, 2011:*

1. *Amend the MRP to reflect the recently updated R2P2 filed with the BLM.*
2. *Amend the MRP with feasible plans to address the mine-water discharge in perpetuity.*

Items I and II of DO-10A were satisfied by a permit amendment received by the Division on August 25, 2010 and approved September 20, 2010 (Task ID 3605). A challenge to the Division's request for financial assurance for long-term mine water treatment under DO-10A and a request for hearing was submitted by Genwal to the Board of Oil, Gas and Mining on September 14, 2010 (Docket No. 2010-026 Cause No. C/015/0032F). A stipulation entered on October 21, 2010 deferred without prejudice the schedule for compliance with DO-10A items III and V until after the Board rules on DO-10A. A second stipulation was entered on November 4, 2010, which extended the deadline for DO-10A Items IV.1 and IV.2 (and Commitment Numbers 2 and 5) to November 30, 2010 and Commitment Numbers 1, 3 and 4 to December 15, 2010.

On November 30, 2010 the Division received two submittals by which Genwal intended to satisfy Commitments Numbers 1 and 2 and DO-10A item IV.1 (Task ID# 3703) and DO-10A item IV.2 (Task ID No. 3704). The Division responded by letter on December 7, 2010 that there were major deficiencies in the submittal and required that Genwal address these deficiencies by December 23, 2010. The Division met with Genwal on December 8, 2010 to discuss the deficiencies and the schedule, and Genwal provided a proposed schedule for addressing the deficiencies on December 9, 2010. The Division responded by letter on December 21, 2010 providing a deadline of January 6, 2011 to respond to the deficiencies identified for Commitments Numbers 2 and 5 and DO-10A items IV.1 and IV.2.

On December 14, 2010 the Division received an amendment from Genwal providing revisions to Appendix 7-65 (Mine Water Treatment System) of the Crandall Canyon MRP (Task 3714). An amendment to Appendix 7-15 (Probable Hydrologic Consequences Determination) was received on January 6, 2011. These revisions were submitted pursuant to DO-10A and commitments in the approved MRP to revise the MRP to accurately reflect conditions at the site. The submittals reviewed in this Technical Memorandum address MRP App. 7-65 Commitment Numbers 1 through 5 and DO Items IV.1 and IV.2. The table on the following page summarizes the status and history for these permitting actions. Materials submitted for Commitment Numbers 1, 2 and 4 are intended as revisions for incorporation into the MRP; materials for Commitment Numbers 3 and 5 were reportedly submitted for informational purposes only and

were not listed on the C1/C2 form as amendments to the MRP. The water treatment system design was previously reviewed by the Division and approved under Task ID# 3461. The material submitted for Task ID Nos. 3714 and 3724 and being reviewed herein covers only modifications made to the water treatment system since the initial approval and construction thereof.

The amendments submitted under Task ID Numbers 3714 and 3724 are not recommended for approval at this time due to numerous deficiencies. A list of the deficiencies identified for these submittals is included in the Recommendations section at the end of this Technical Memorandum.

DO-10A Items		Original Deadline	Status
I	Monitor mine-water discharge chemistry and flow	Upon receipt of DO-10A	Completed (Task ID 3605)
II	Amend the MRP to reflect monitoring by DO-10A Item I	August 31, 2010	Completed (Task ID 3605)
III	Provide financial assurance to cover long-term mine-water treatment	October 16, 2010	Deferred, pending Board decision per October 21, 2010 Stipulation
IV	1. Amend the MRP to reflect current treatment operations	October 31, 2010	Deadline extended to November 30, 2010 by November 4, 2010 Stipulation. Information received November 30 (Task 3703). Task 3703 found deficient/denied December 7, 2010, new deadline December 23, 2010. Deadline extended to January 6, 2011 per December 21, 2010 Division Letter. Amendment received December 14, 2010 (Task 3714), additional figure received January 6, 2011 (Task 3724)
	2. Revise the PHC determination	October 31, 2010	Deadline extended to November 30, 2010 by November 4, 2010 Stipulation. Information received November 30 (Task 3704). Task 3704 found deficient/denied December 7, 2010, new deadline December 23, 2010. Deadline extended to January 6, 2011 per December 21, 2010 Division Letter. Amendment received January 6, 2011 (Task 3724). Hydrogeologic work plan received January 26, 2011, returned deficient February 7, 2011. Revised work plan to be submitted by February 24, 2011
V	1. Amend the MRP to reflect updated R2P2 filed with the BLM. 2. Amend the MRP to address the mine-water discharge in perpetuity.	March 31, 2011	Deferred, pending Board decision per October 21, 2010 Stipulation
MRP App. 7-65 Commitment Numbers		Original Deadline	Status
1	Deletion of any previously approved language, discussion or attachment that is no longer relevant	November 30, 2010	Deadline extended to December 15, 2010 by November 4, 2010 Stipulation. Amendment received December 14, 2010 (Task 3714)
2	Revisions that reflect the design, as-built construction, operation, clean out and maintenance aspects of the Mine Discharge Water Iron Treatment System	November 30, 2010	Information received November 30 (Task 3703). Task 3703 found deficient/denied December 7, 2010, new deadline December 23, 2010. Deadline extended to January 6, 2011 per December 21, 2010 Division Letter. Amendment received December 14, 2010 (Task 3714), with additional information submitted January 6, 2011 (Task 3724)

3	<i>A summary/chronology of the experimental process that led to the final design</i>	November 30, 2010	Deadline extended to December 15, 2010 by November 4, 2010 Stipulation. Information was received December 14, 2010 (Task 3714) but was not included on C1/C2 form
4	<i>A discussion of iron sludge disposal options as contingency in the event that the Wildcat Loadout facility is no longer available to receive the material.</i>	November 30, 2010	Deadline extended to December 15, 2010 by November 4, 2010 Stipulation. Amendment received December 14, 2010 (Task 3714). Sludge disposal plan returned deficient February 3, 2011, revised sludge disposal plan requested by March 10, 2011.
5	<i>An up to date summary of the operational costs for the operational water treatment system configuration</i>	November 30, 2010	Information received November 30 (Task 3703). Task 3703 found deficient/denied December 7, 2010, new deadline December 23, 2010. Deadline extended to January 6, 2011 per December 21, 2010 Division Letter. Cost information was received January 6, 2011 (Task 3724) but was not included on the C1/C2 form

**TECHNICAL ANALYSIS:**

**GENERAL CONTENTS**

**REPORTING OF TECHNICAL DATA**

Regulatory Reference: 30 CFR 777.13; R645-301-130.

**Analysis:**

MRP Appendix 7-65 Commitment Number 3 requires Genwal to submit a revision to the MRP providing a summary/chronology of the experimental process that led to the final design including:

- A summary of the various treatment methods that were examined/tested.
- A discussion as to the chemical additives that were employed during the trial and error process. The discussion shall include the ratios of chemicals that were utilized in the various test configurations as well as the corresponding water quality results.
- An up to date tabulation of the mine-water flow data that has been collected since the installation of the AVF Flow Meter
- The field data and lab analytical results that were obtained during the various test configurations/water treatment approaches that were explored.

The information submitted with TID 3714 was not included on the C1/C2 form, and will need to be re-submitted as an MRP amendment.

**Treatment Technology Screening**

The submittal identifies that a oxidizer (Maelstrom) unit was installed, followed by a period of testing treatment chemicals and sludge recirculation configurations. Sludge was reportedly sent to dewatering companies for testing July 2010. A trial using a GeoBag filtration device was performed October 2010, and a trial using a cyclone was performed November 2010.

***Missing information:***

- *Consultant reports and descriptions for technology screening, if any, prior to selection of oxidizer unit*
- *Oxidizer(Maelstrom) unit bench testing information*
- *Consultant reports from the three Geotube companies and one press company to which sludge samples were sent July 2010*
- *Consultant reports describing successful "Geobag" testing completed October 2010, including Geobag specifications, operating conditions, concentrations and types of additional treatment chemicals employed.*

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TECHNICAL MEMO

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- *Consultant report(s) for cyclone testing completed 11/5/2010 (type of cyclone and operation settings)*

Chemical Additives

The submittal identifies that six water treatment chemicals were utilized for treatment experiments. For some of the chemicals utilized, the permittee included a qualitative description of performance based on visual observations of flocculent. No chemical concentrations are reported, nor are any analytical results provided except for the monthly UPDES / pre-treatment mine water sampling results which do not appear to correlate with any of the dates where chemicals were evaluated.

*Missing information*

- *Concentrations of treatment chemicals used:*
  - 2/24/2010 - Sodium Hydroxide (NaOH)*
  - 2/25/2010 - Nalco 7763 plus NaOH*
  - 3/15-16/2010 - Nalco 7763 and Nalco 7888 (8187)*
  - 3/19/2010 - Nalco 8158*
  - 3/25/2010 - NeoSolutions 18100*
  - 4/16/2010 - Nalco 8187*
  - 10/20/2010 - Solve 151*
- *Analytical Results / polymer testing results from Nalco and WaterSolve*

Field Data and Lab Analytical Results

The submittal includes a chronology of work completed at the site. For some entries, qualitative observations of flocculant appearance are provided. No measurements (sludge settling times, field-measured iron concentrations, turbidity measurements, etc.) were provided. No analytical results provided except for the monthly UPDES / pre-treatment mine water sampling results which do not appear to correlate with any of the dates where chemicals were evaluated. No results or descriptions of experimentation to quantify residual treatment chemical (polymer) concentrations are included.

*Missing information:*

- *Field measurements (sludge settling times, field-measured iron concentrations, turbidity measurements, etc.) used to evaluate treatment effectiveness*
- *Laboratory analytical results for samples analyzed to evaluate treatment effectiveness*

Mine-water Flow Data

A set of tables summarizing mine-water flow data was provided with the Task 3714 submittal. One table presents flows recorded once daily between January 1, 2011 and May 31, 2011, and a second table presents flows recorded twice daily between June 1, 2010 and November 30, 2010. Footnotes on the first table state that "Old meter not accurate" and "New meter installed 03/19/2010".

*Missing information:*



## TECHNICAL MEMO

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- *The Permittee does not specify the date that the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.*

### Sludge Disposal

The submittal includes information reflecting three sludge disposal events. Between April 13 and May 7, 2010, 38 loads / 216,000 gallons of sludge was hauled to Wildcat Loadout between July 19 and August 23, 2010 sludge sent to Crandall sediment pond (volume not identified). In November 2010, sludge was again sent to Crandall sediment pond (specific dates and volume not identified).

#### *Missing information*

- *Volume sludge sent to Crandall Sediment pond between July 19 and August 23, 2010*
- *Specific dates and volume of sludge sent to Crandall sediment pond November 2010.*

### **Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Mining Rules.

## **ENVIRONMENTAL RESOURCE INFORMATION**

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

## **HYDROLOGIC RESOURCE INFORMATION**

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

### **Analysis:**

#### **Probable Hydrologic Consequences (PHC) Determination**

DO-10A Item IV.2 requires the Permittee to “[r]evise the Probable Hydrologic Consequences (PHC) determination in the MRP to reflect current conditions for the Crandall Canyon Mine. The new PHC must address the impact to water quantity and quality and aquatic habitat. It must also include water-monitoring recommendations, and describe how water-monitoring data will be used.”

The Permittee submitted a PHC update on November 30, 2010 (Task ID #3704); however, this submittal was found to not meet the requirements of DO-10A and was returned as deficient on December 7, 2010. The Division met with the Permittee on December 8, 2010 to discuss the deficiencies identified with the November 30, 2010 submittal and agreed that the Permittee would submit a timeline for responding to these deficiencies. The Division received a

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TECHNICAL MEMO

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letter from the Permittee on December 9, 2010 proposing to update the PHC in November 2011. The Division responded by letter on December 21, 2010 that the Permittee must: update selected portions of the PHC with available data by January 6, 2011; provide a work plan for the hydrologic investigation by January 27, 2011; and complete revisions to the PHC by November 2011. The Permittee responded to the deficiencies identified in the Division's December 7, 2010 letter and the schedule prescribed by the Division's December 21, 2010 letter by submitting a revised PHC (Task ID # 3724) and the Work Plan (Task ID # 3732).

Revised PHC Determination

The revised update to Appendix 7-15 (PHC Determination) was reviewed for compliance with the requirements of Rule R645-301-728 - Probable Hydrologic Consequences (PHC) Determination. The subsections below summarize this review and identify the deficiencies of the submittal.

**R645-301-728.200 – Basis for determination**

Most of the determinations made in the revised PHC are supported by baseline and operational data collected by the Permittee. In some sections, the Permittee makes statements which are not accompanied by supporting data or references.

In accordance with **R645-301-728.200** and **R645-301-122**, the Permittee must supply supporting data providing a basis for these determinations, or modify/remove the following statements in Appendix 7-15:

- Groundwater Interception, 3rd paragraph, Page 2: Provide data to support the observation that the source of groundwater intercepted by the mine in Section 26 & 35, T15S, R6E is release from storage.
- Groundwater Interception, 4th paragraph, Page 3: Provide basis (not just a reference to Division's water database) for the conclusion that springs within the permit area have not been affected by mining operations.
- Spring and Seep Interception, 4th paragraph, page 7: Define the dates for the "period of active mining" when inflows were "modest in magnitude and of short duration". Identify the date(s), flow rates and the specific locations within the mine where "appreciable groundwater inflows were encountered". Provide data to support the observation that the source of groundwater intercepted by the mine in Section 26 & 35, T15S, R6E is release from storage.
- Spring and Seep Interception, 6th paragraph, page 8: Identify when the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.
- Pumping from Crandall Creek, page 10: Provide the "baseline water flow which needs to remain within Crandall Creek to sustain the existing flora and fauna" which Genwal committed to have determined by August 31, 1995.
- Mine Water Discharge, 10th paragraph, page 14: Provide WET testing reports

**TECHNICAL MEMO**

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- Mine Water Discharge, 12th paragraph, page 14: For the chemicals referred to in list item 2), identify the specific chemicals being used to treat the water, their application rates and the applicable NSF60 criteria and provide a commitment in the MRP that chemical usage rates will not exceed NSF60 criteria.
- Mine Water Discharge, 16th paragraph, page 15: Provide data, reports, field notes and/or observations from “experiences at the Crandall Canyon Mine and other coal mining operations in the Wasatch Plateau” which support the estimate that “elevated iron concentrations will not persist more than about 10 years”.

**R645-301-728.310 – Adverse Impacts to the Hydrologic Balance**

The Permittee summarizes the potential adverse impacts to the hydrologic balance on Table 1. The descriptions included in Table 1 are based on the PHC determination presented in Section R645-301-728.100.

In accordance with R645-301-728.310, the Permittee must correct the following errors or deficiencies in Table 1 to describe whether adverse impacts may occur to the hydrologic balance:

- Acid-toxic Materials, Table 1, page 24: The likelihood of toxic-forming materials must be shown as either “moderate” or “high”. The elevated (greater than 1 mg/L) iron concentrations in the untreated mine water discharge are evidence that “toxic-forming materials” are present within the coal, overburden, or underburden at the Crandall Canyon mine.
- Groundwater Availability, Table 1, page 24: The “probability of occurrence” for “interception of groundwater by mine workings” is “high (observed)” not “low”. This table entry must be revised to agree with the groundwater discussion presented elsewhere in the PHC.
- Groundwater Quality, Table 1, page 24: The quality of groundwater being discharged from the Crandall Canyon mine is degraded to the point that treatment is required; therefore. “Elevated dissolved solids and iron concentrations” must be added as a potential impact to groundwater quality with a probability of occurrence of “high (observed)”.
- Surface Water Quality, Table 1, Page 24: An entry is required identifying “spilled or residual treatment chemicals” as a potential impact to surface water quality.
- Surface Water Quantity, Table 1, page 24: The permittee must revise this table entry or explain how mine discharge treatment to reduce iron concentrations is a mitigation measure for surface water quantity.

**R645-301-728.320 – Acid-forming and Toxic-forming Materials**

The discussion of toxic-forming materials in the 1st paragraph of the Acid-toxic Materials section (page 18) and Findings Section 728.320 must be revised. The elevated (greater than 1 mg/L) iron concentrations in the untreated mine water discharge are evidence that “toxic-

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TECHNICAL MEMO

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forming materials” are present within the coal, overburden, or underburden at the Crandall Canyon mine. Iron in water and precipitated on stream substrate are likely to be detrimental to biota or uses of the water (see Vouri, Kari-Matti. 1995. Direct and Indirect effects of Iron on River Ecosystems. Finnish Zoological and Botanical Publishing Board, Ann. Zool. Fennici, Vol 32:317-329).

**R645-301-728.330 – Impacts from Coal Mining and Reclamation Activities**

The PHC Determination includes a discussion of the potential or observed impacts of the coal mining and reclamation operations on sediment yield (R645-301-728.331), water quality (R645-301-728.332), flooding or streamflow alteration (R645-301-728.333) and groundwater and surface water availability (R645-301-728.334) and other characteristics required by the Division (R645-301-728.335). To date, the Division has not requested any additional characteristics be evaluated.

In accordance with **R645-301-728.330**, the Permittee must address the following deficiencies relating to potential impacts from coal mining and reclamation operations:

- The Permittee must either modify or support the findings that it is “unlikely” that “groundwater quantity or quality will be affected by the underground mining operation” (PHC Section 728.332) and why the “Crandall Canyon Mine is expected to have little impact on groundwater” (PHC Section 728.334). The explanation must consider that the mine discharges approximately 500 gallons per minute of intercepted groundwater which requires treatment due to its poor water quality.
- The permittee must address the impacts on the hydrologic balance of intercepting groundwater and discharging groundwater at approximately 500 gallons per minute.
- The permittee fails to address potential impacts on surface water quality from utilizing water treatment chemicals, either resulting from either spills of unused chemical products or from residual chemicals in the treated mine water effluent. The permittee must identify the specific chemicals being used to treat the water and the sampling and analytical methods used to monitor for residual treatment chemicals in the treated mine water discharge and/or the receiving water(s).
- In the section Mine Water Discharge (18th paragraph, page 16 and last paragraph, page 20), the Permittee must describe how monitoring the mine-water chemistry prior to treatment will support an evaluation of the effect of discharge of treated water to the receiving water (Crandall Canyon Creek). The Permittee must also describe procedures for monitoring the concentrations of residual water treatment chemicals being introduced to Crandall Canyon Creek.

**R645-301-.350 – State-appropriated Water**

## TECHNICAL MEMO

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The revised PHC does not contain a section describing whether underground coal mining and reclamation activities will result in contamination, diminution or interruption of State-appropriated water supplies.

### **Accuracy, Clarity and Reporting of Technical Data**

Rule R645-301-120 requires permit application contents to contain current information (R645-301-121.100) and to be clear and concise (R645-301-121.200). In accordance with **R645-301-120**, the permittee must address the following deficiencies:

- Groundwater Interception, 4th paragraph, Page 3: Define the “northwest portion of the Crandall Canyon mine” and provide date that the northwest portion of the mine was sealed.
- Groundwater Interception, 6th paragraph, Page 3 AND Mine Water Discharge, 3rd paragraph, page 12: Either provide a map showing the geometry of the mine after the 2007 collapse, or modify the statements to read “...based on the geometry of the Crandall Canyon Mine workings prior to the 2007 collapse....”
- Groundwater Interception, last paragraph, Page 6: Update the tense used in this paragraph and provide date(s) that the CVSSD culinary water treatment plant was constructed.
- Increased Sediment Loading, 2nd paragraph, page 11: The storage volume values provided for the discussion of the sediment pond do not agree with values provided in Appendix 7-4 Sediment and Drainage Control Plan, Table 11 Sediment Pond Design.
- Mine Water Discharge, 16th paragraph, page 15: Define what is meant (including numeric values) by the phrase “elevated iron concentrations”, and define from what date Genwal is predicting these elevated iron concentrations to “not persist more than about 10 years” – e.g., from January 2011.
- Figure PHC-1: Correct the units shown for the y-axis of this figure, and add a footnote identifying that “Flow measurements prior to 3/19/2010 are not accurate” and identifying the date when the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.
- PHC Attachment: No reference to this attachment is made in the text of Appendix 7-15; therefore, the Permittee should either remove this attachment or add explanations of the data presented in the attachment at appropriate sections of Appendix 7-15.

### Hydrogeologic Work Plan for 2011 PHC Update

On January 26, 2011 the Division received a letter from Genwal’s legal counsel providing a hydrogeologic work plan for the Crandall Canyon Mine. The work plan was submitted by the Permittee pursuant to a request made by the Division in a letter dated December 21, 2010. The objective of the Work Plan is to provide information necessary to update the PHC determination for the Crandall Canyon mine to describe the ongoing mine water discharge from the sealed north portals, as required by Division Order DO-10A. As the work plan was not an amendment to the MRP, the plan was reviewed as a Special Project (Task 3732). The information submitted was found to not meet the minimum technical requirements of the R645

**TECHNICAL MEMO**

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Coal Mining Rules because the plan lacked sufficient detail for the Division to determine whether it meets its stated objectives. A deficiency letter was provided to the Permittee on February 7, 2011, requesting that a revised work plan be submitted by February 24, 2011.

**Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Mining Rules.

## **OPERATION PLAN**

### **SPOIL AND WASTE MATERIALS**

Regulatory Reference: 30 CFR Sec. 701.5, 784.19, 784.25, 817.71, 817.72, 817.73, 817.74, 817.81, 817.83, 817.84, 817.87, 817.89; R645-100-200, -301-210, -301-211, -301-212, -301-412, -301-512, -301-513, -301-514, -301-521, -301-526, -301-528, -301-535, -301-536, -301-542, -301-553, -301-745, -301-746, -301-747.

**Analysis:**

#### **Disposal of Noncoal Mine Wastes**

MRP Appendix 7-65 Commitment Number 4 requires the Permittee to submit a revision to MRP Appendix 7-65 providing “[a] discussion of iron sludge disposal options as contingency in the event that the Wildcat Loadout facility is no longer available to receive the material.” The submittal for Task 3714 identifies that under the approved plan, sludge is disposed at Wildcat Loadout (permit C0070033) in Pond C. Wildcat Loadout is in the process of being transferred from Andalex Resources (a sister company of Genwal) to Intermountain Power Agency. Task 3714 identifies Pond A at the Centennial Mine (permit C0070019) as an alternate disposal site.

The mine water treatment sludge generated at Crandall Canyon Mine is a noncoal mine waste which must be managed and disposed accordingly. Rules R645-301-542.741 and R645-301-747 require noncoal mine waste to be placed and stored in a designated portion of the permit area, and to be disposed of either in a designated disposal site within the permit area or at a state-approved solid waste disposal area. Under the R645 Utah Coal Mining Rules, noncoal mine waste from the Crandall Canyon mine cannot be transported to or disposed of at other mine permit areas, including Centennial Mine and Wildcat Loadout.

The Permittee identifies that the sludge material from the treatment system was tested for RCRA metals and other constituents; however, the laboratory results are included in Attachment 9 which is marked for deletion in the amendment submittal. The permittee must include in the MRP the analytical results for treatment sludge and supernatant which were previously included as Exhibits 4, 5 and 6 of the Deleted Attachment 9 to Appendix 7-65 (R645-301-131).

## **Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Mining Rules. The sludge management plan was returned deficient on February 3, 2011. Genwal must submit a revised sludge management plan by March 10, 2011. Genwal should also include copies of the laboratory analysis of sludge for RCRA metals and solids.

## **HYDROLOGIC INFORMATION**

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

## **Analysis:**

### **Other Treatment Facilities**

Item IV.1 of DO-10A requires the Permittee to “[a]mend the MRP to reflect the current operations, especially the "operational" treatment measures and facilities associated with the ongoing mine-water discharge, including all aspects of the treatment process with associated costs (capital, operations, maintenance) and as-built drawings.” MRP Appendix 7-65 Commitment Numbers 1 and 2 require the Permittee to submit a revision to MRP Appendix 7-65 deleting “any previously approved language, discussion or attachment that is no longer relevant or applicable based upon current conditions” and revising the appendix to “reflect the design, as-built construction, operation, clean out and maintenance aspects of the Mine Discharge Water Iron Treatment System.”

The BACKGROUND section (Appendix 7-65 p. 1) has been updated to reflect modifications made to the treatment system since its initial construction. The background section identifies three basic unit operations: the aeration unit, a chemical injection system, and a settling basin. This statement should be revised to identify the sludge recirculation and sludge disposal unit operations which are part of the treatment process currently used at the site (R645-301-121).

The INSTALLATION OF SETTLING BASIN section describes the construction of the settling basin. The volume of the settling basin (38,500 cubic feet or 288,000 gallons) is shown Figure 1 of Attachment 8. No revisions were included to the INSTALLATION OF SETTLING BASIN section of Appendix 7-65. Since initially constructed, the settling basin has been modified with baffles to help prevent short circuiting in the basin. These modifications to the settling basin are described in the revisions to the INSTALLATION OF CHEMICAL INJECTION SYSTEM section of the Appendix.

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TECHNICAL MEMO

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The INSTALLATION OF CHEMICAL INJECTION SYSTEM section describes the chemical injection systems installed for coagulant and flocculant addition. This section also describes the sludge recirculation unit operation. The coagulant and flocculant are identified as Nalco 8187 and Nalco 7763, respectively, and MSDS are provided as Attachment 10. These chemicals have NSF/ANSI Standard 60 certifications for use in domestic drinking water treatment operations at concentrations of 1 mg/L (Nalco 7763) and 180 mg/L (Nalco 8187). The text of Appendix 7-65 does not identify the concentrations of coagulant and flocculants being used under current operational conditions; however, the Mine Water Treatment As-Built Flow Diagram (Task 3724) identifies the approximate dosage rates (as of December 2010) as 5 mg/L (Nalco 7763 flocculant) and 38 mg/L (Nalco 8187 coagulant). The amendment states that a make-down unit is operated to produce a flocculant solution "with a consistent, known and pre-determined concentration"; however, this concentration is not identified. The sludge recirculation rate is not identified, but has been reported by the operator as approximately 450 gpm. Genwal must revise the amendment to identify: the concentrations of coagulant and flocculant being used under current operating conditions; the concentration of flocculant prepared in the make-down unit; and the sludge recirculation rate being used under current operating conditions (R645-301-120, R645-301-731, R645-301-728).

During discussions with the Division, the Manti-La Sal National Forest and DWQ in February 2010, Genwal committed to work with its vendor(s) to identify an analytical test method to quantify the residual treatment chemical carryover into receiving waters. Until an analytical method was available and demonstrated to be effective at determining chemical carryover, Genwal agreed to not use treatment chemicals at dosage rates exceeding the NSF60 certification. Based on the analytical results for chemical carryover testing, Genwal could then propose to use treatment chemicals at concentrations greater than the NSF60 certification. The following commitment should be added to the MRP: Only treatment chemicals certified under NSF60 will be utilized for the mine water treatment system, and Genwal will monitor the dosage rate (in mg/L) for all treatment chemicals used. Genwal will monitor treated water for carryover of treatment chemicals on a monthly basis or when dosage rates or chemical products are changed. Dosage rates will not exceed the NSF60 certified concentrations without a prior demonstration to the Division, Forest Service and DWQ that elevated dosage rates are acceptable based on analytical results for treated water samples. (R645-301-731)

The CLEAN OUT section of Appendix 7-65 has been modified by removing outdated information and by describing modifications made to the treatment system since its initial construction. Modifications include installation of perforated pipes to assist in vacuum cleaning of the settling basin, sludge recirculation to improve sludge density, experimentation with sludge dewatering technologies, and the identification of the Centennial Mine as an alternative sludge disposal site. The revised text does not identify the frequency at which the settling basin requires cleaning. The treatment system came on-line in February 2010, and sludge has been cleaned from the settling basin three times since then: April 13 to May 7, 2010; July 19 to August 23,



**TECHNICAL MEMO**

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2010; and most recently in November 2010. Based on the operational history of the treatment system, sludge cleanout appears to be required on an approximately quarterly basis.

Genwal must revise Appendix 7-65 to identify the approximate clean out frequency under current operating conditions (e.g., quarterly) and include criteria used to determine when clean out will be performed, e.g., prior to sludge accumulation in the settling basin cell closest to the outfall (R645-301-742.230). The proposed revisions to this section of Appendix 7-65 delete text describing precautions to be taken during cleanout to help minimize agitation of settled iron precipitate and to help prevent agitated precipitate from discharging to Crandall Creek. The following text must be maintained in Appendix 7-65 page 7 (R645-301-731):

“Care will be taken during the clean-out process to minimize stirring up the accumulations so that suspended iron particles do not flow out of the pond. During the clean-out process, excelsior logs or other suitable sediment control (filtration) devices will be installed at the basin outlet spillway to help trap any iron material stirred up. Visual observations and sampling of the water will be made at the spillway (i.e., UPDES monitoring point) to make certain that stirred up iron material is not exiting the basin. If needed, cleaning operations will be delayed until sufficient time is allowed to re-settle any stirred up material.”

As described under the Noncoal Mine Waste Disposal section of this memo, the mine water treatment sludge generated at Crandall Canyon Mine is a noncoal mine waste which must be managed and disposed accordingly. Under the R645 Utah Coal Mining Rules, noncoal mine waste from the Crandall Canyon mine cannot be transported to or disposed of at other mine permit areas, including Centennial Mine and Wildcat Loadout. The sludge management plan component of TID 3714 was returned deficient on February 3, 2011. Genwal must submit a revised sludge management plan by March 10, 2011.

The MAINTENANCE section of Appendix 7-65 provides a description of the procedure to be followed if maintenance is necessary for the oxidizer unit. No updates to the Maintenance section were included with Tasks 3714 or 3724. When maintenance is required, untreated mine water would be routed to the primary settling pond while repairs are made to the oxidizer unit or settling basin. Calculations and assumptions described by the Permittee indicate that an approximately 8-hour window is possible for maintenance, and that an 8-hour window should provide sufficient time given “the mechanical simplicity of the system”. Since the initial construction of the treatment system, seven pumps, two chemical injection systems, two flow meters, and hundreds of feet of piping have been added to the system. The Permittee must revise the Maintenance Section of Appendix 7-65 to remove references to a “mechanically simple system” and to demonstrate that necessary repairs to any of the pumps, chemical injection systems, flow meters, or piping can be accomplished within the 8-hour window available by routing untreated mine water to the settling basin (R645-301-731).

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TECHNICAL MEMO

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The FINAL RECLAMATION and BONDING sections of Appendix 7-65 have been entirely deleted. Deficiencies related to the Reclamation Plan and Bonding are discussed in those sections, below.

The BASELINE MONITORING section was only modified by removing references to the use of monitoring data for “revised” or “final” reclamation plans. This section of Appendix 7-65 was not updated to reflect the additional monitoring required under Item I of DO-10A. To simplify the MRP, discussion of ongoing monitoring associated with the mine water discharge and groundwater seepage from the highwall face should be located in the Section 7.31.2 of the MRP (R645-301-731.200)

The CONSTRUCTION SPECIFICATIONS AND DRAWINGS information in Attachment 8 describes the construction of the water treatment system as initially designed. The specifications therefore only include construction of the settling basin, water conveyance from the portals to the oxidizer unit and oxidizer unit installation. Since initially constructed, seven pumps, two chemical injection systems, two flow meters, and hundreds of feet of piping have been added to the system. A revised as-built Figure (Attachment 8 Figure 1) for the iron treatment system was included in a November 30, 2010 submittal (Task 3703) that was returned as deficient to the Permittee. The revised as-built was not included in either submittal for Tasks 3714 or 3724. A process-flow diagram included with Task 3724 accurately depicts the current water treatment system configuration at the site; however, the process flow diagram shows six fabric curtains separating cells within the sedimentation when only 4 curtains are present. The Permittee must update Appendix 7-65 Attachment 8 (Construction Specifications and Drawings) to describe the installation of all aspects of the water treatment system, including the seven pumps, two chemical injection systems, two flow meters and associated piping and controls. The Permittee must also include the revised Iron Treatment Facility As-Built Plan (Sheet 1 from the November 30, 2010 submittal) and correct the number of fabric curtains shown in the Process Flow Diagram Figure (R645-301-121.100).

### **Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Rules. Prior to approval by the Division, Genwal must address the deficiencies identified above and listed in the Recommendations section below.

## **RECLAMATION PLAN**

### **HYDROLOGIC INFORMATION**

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

**Analysis:**

**Hydrologic Reclamation Plan**

The Permittee has deleted the entire discussion of long-term mine water treatment from Appendix 7-65. In addition, there is no discussion of the reclamation of the operational mine water treatment system. The Permittee has not provided a reclamation plan which accounts for the mine water discharge, groundwater seepage from the highwall face, or potential permanent treatment facility for mine water discharge.

**Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Mining Rules relating to the Hydrologic Reclamation Plan. The Permittee must include a description of the removal and reclamation of the operational treatment system and a description of the permanent diversion and treatment facility as necessary to accommodate the mine water discharge and groundwater seepage from the highwall. (R645-301-761)

**BONDING AND INSURANCE REQUIREMENTS**

Regulatory Reference: 30 CFR Sec. 800; R645-301-800, et seq.

**Analysis:**

**Determination of Bond Amount**

The Permittee is required to provide the Division an MRP amendment including cost information for the water treatment system based on Commitment Number 5 in Appendix 7-65 of the approved MRP and DO-10A Item IV.1. Costs were not provided as an amendment to the MRP in either Task 3714 or 3724 submittals. Furthermore, the cost information included with the cover letter for Task 3724 do not meet the format or content requirements which have been clearly communicated to Genwal.

The Permittee has deleted all discussion of bonding from Appendix 7-65. The Permittee must include a discussion of the reclamation of the water treatment system and associated cost information for purposes of reclamation bond calculation.

**Findings:**

The material submitted does not meet the minimum requirements of the Utah Coal Mining Rules for Bonding. The Permittee must submit an amendment to the MRP with projected cost information for the water treatment system for the following line items:

- Equipment Costs

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TECHNICAL MEMO

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- Chemical Costs (annual)
- Sludge cleanout, transportation, and disposal (annual)
- Electrical Costs (annual)
- Propane Costs (annual)
- Operational Labor (annual)
- Maintenance Labor (annual)

The Permittee must also include in the MRP cost estimates for removal / reclamation of the operational mine water treatment system (R645-301-830).

**RECOMMENDATIONS:**

The applications are not recommended for approval at this time. Prior to approval the Permittee must address the following deficiencies:

**Experimental Treatment Design Information**

**R645-300-143** The information describing the experimental treatment design must be submitted as an amendment to the MRP.

**R645-301-120, R645-301-130, R645-301-731** The permittee must provide the following information, or state that the information is unavailable and provide the reason that the information was not collected:

Treatment Technology Screening

- Consultant reports and descriptions for technology screening, if any, prior to selection of oxidizer unit
- Oxidizer(Maelstrom) unit bench testing information
- Consultant reports from the three Geotube companies and one press company to which sludge samples were sent July 2010
- Consultant reports describing successful "Geobag" testing completed October 2010, including Geobag specifications, operating conditions, concentrations and types of additional treatment chemicals employed.
- Consultant report(s) for cyclone testing completed 11/5/2010 (type of cyclone and operation settings)

Chemical Additives

- Concentrations of treatment chemicals used:
  - 2/24/2010 - Sodium Hydroxide (NaOH)
  - 2/25/2010 - Nalco 7763 plus NaOH
  - 3/15-16/2010 - Nalco 7763 and Nalco 7888 (8187)
  - 3/19/2010 - Nalco 8158
  - 3/25/2010 - NeoSolutions 18100

## TECHNICAL MEMO

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- 4/16/2010 - Nalco 8187
  - 10/20/2010 – Solve 151
- Consultant reports and analytical results for polymer testing results from Nalco and WaterSolve

### Field Data and Lab Analytical Results

- Field measurements (sludge settling times, field-measured iron concentrations, turbidity measurements, etc.) used to evaluate treatment effectiveness
- Laboratory analytical results for samples analyzed to evaluate treatment effectiveness

### Mine-water Flow Data

- Date that the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.

### Sludge Disposal

- Volume sludge sent to Crandall Sediment pond between July 19 and August 23, 2010
- Specific dates and volume of sludge sent to Crandall sediment pond November 2010.

## **Appendix 7-65 Mine Discharge Water Iron Treatment Facility**

**R645-301-121** The Background section of Appendix 7-65 must be corrected to identify all components of the water treatment system. The water treatment system comprises five unit operations: aeration, chemical addition, sludge recirculation, settling / clarification, and sludge disposal.

**R645-301-120, R645-301-731, R645-301-728** Genwal must revise the amendment to identify: the concentrations of coagulant and flocculant being used under current operating conditions; the concentration of flocculant prepared in the make-down unit; and the sludge recirculation rate being used under current operating conditions.

**R645-301-731** Genwal must add a commitment that only treatment chemicals certified under NSF60 will be utilized for the mine water treatment system, and Genwal will monitor the dosage rate (in mg/L) for all treatment chemicals used. Genwal will monitor treated water for carryover of treatment chemicals on a monthly basis or when dosage rates or chemical products are changed. Dosage rates will not exceed the NSF60 certified concentrations without a prior demonstration to the Division, Forest Service and DWQ that elevated dosage rates are acceptable based on analytical results for treated water samples.

**R645-301-742.230** Genwal must revise Appendix 7-65 to identify the approximate clean out frequency under current operating conditions (i.e., quarterly) and include criteria used to determine when clean out will be performed, e.g., prior to sludge accumulation in the settling basin cell closest to the outfall.

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TECHNICAL MEMO

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**R645-301-731** The following text must be maintained in Appendix 7-65 page 7: “Care will be taken during the clean-out process to minimize stirring up the accumulations so that suspended iron particles do not flow out of the pond. During the clean-out process, excelsior logs or other suitable sediment control (filtration) devices will be installed at the basin outlet spillway to help trap any iron material stirred up. Visual observations and sampling of the water will be made at the spillway (i.e., UPDES monitoring point) to make certain that stirred up iron material is not exiting the basin. If needed, cleaning operations will be delayed until sufficient time is allowed to re-settle any stirred up material.”

**R645-301-131** The permittee must include in the MRP the analytical results for treatment sludge and supernatant which were previously included as Exhibits 4, 5 and 6 of the Deleted Attachment 9 to Appendix 7-65.

**R645-301-731** The Permittee must revise the Maintenance Section of Appendix 7-65 to remove references to a “mechanically simple system” and to demonstrate that necessary repairs to any of the pumps, chemical injection systems, flow meters, or piping can be accomplished within the 8-hour window available by routing untreated mine water to the settling basin.

**R645-301-731.200** The Permittee should remove from Appendix 7-65 discussion of ongoing water monitoring associated with the mine water discharge and groundwater seepage from the highwall face and update Section 7.31.2 of the MRP, as appropriate, to describe ongoing monitoring.

**R645-301-761** Permittee must include a description of the removal and reclamation of the operational treatment system and a description of the permanent diversion and treatment facility as necessary to accommodate the mine water discharge and groundwater seepage from the highwall.

**R645-301-830** The Permittee must submit an amendment to the MRP with projected cost information for the water treatment system for the following line items:

- Equipment Costs
- Chemical Costs (annual)
- Sludge cleanout, transportation, and disposal (annual)
- Electrical Costs (annual)
- Propane Costs (annual)
- Operational Labor (annual)
- Maintenance Labor (annual)

The Permittee must also include in the MRP cost estimates for removal / reclamation of the operational mine water treatment system.

**R645-301-121.100** The Permittee must update Appendix 7-65 Attachment 8 (Construction Specifications and Drawings) to describe the installation of all aspects of the water treatment system, including the seven pumps, two chemical injection systems, two flow meters and associated piping and controls. The Permittee must also include the revised Iron Treatment Facility As-Built Plan (Sheet 1 from the November 30, 2010 submittal) and correct the number of fabric curtains shown in the Process Flow Diagram Figure.

#### **Appendix 7-15 Probable Hydrologic Consequences Determination**

**R645-301-122, R645-301-130, R645-301-728.200 Permittee** must supply supporting data providing a basis for these determinations, or modify/remove the following statements in Appendix 7-15:

- Groundwater Interception, 3rd paragraph, Page 2: Provide data to support the observation that the source of groundwater intercepted by the mine in Section 26 & 35, T15S, R6E is release from storage.
- Groundwater Interception, 4th paragraph, Page 3: Provide basis (not just a reference to Division's water database) for the conclusion that springs within the permit area have not been affected by mining operations.
- Spring and Seep Interception, 4th paragraph, page 7: Define the dates for the "period of active mining" when inflows were "modest in magnitude and of short duration". Identify the date(s), flow rates and the specific locations within the mine where "appreciable groundwater inflows were encountered". Provide data to support the observation that the source of groundwater intercepted by the mine in Section 26 & 35, T15S, R6E is release from storage.
- Spring and Seep Interception, 6th paragraph, page 8: Identify when the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.
- Pumping from Crandall Creek, page 10: Provide the "baseline water flow which needs to remain within Crandall Creek to sustain the existing flora and fauna" which Genwal committed to have determined by August 31, 1995.
- Mine Water Discharge, 10th paragraph, page 14: Provide WET testing reports
- Mine Water Discharge, 12th paragraph, page 14: For the chemicals referred to in list item 2), identify the specific chemicals being used to treat the water, their application rates and the applicable NSF60 criteria and provide a commitment in the MRP that chemical usage rates will not exceed NSF60 criteria.
- Mine Water Discharge, 16th paragraph, page 15: Provide data, reports, field notes and/or observations from "experiences at the Crandall Canyon Mine and other coal mining operations in the Wasatch Plateau" which support the estimate that "elevated iron concentrations will not persist more than about 10 years".

**R645-301-728.310** The Permittee must correct the following errors or deficiencies in Table 1 to describe whether adverse impacts may occur to the hydrologic balance:

TECHNICAL MEMO

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- Acid-toxic Materials, Table 1, page 24: The likelihood of toxic-forming materials must be shown as either “moderate” or “high”. The elevated (greater than 1 mg/L) iron concentrations in the untreated mine water discharge are evidence that “toxic-forming materials” are present within the coal, overburden, or underburden at the Crandall Canyon mine.
- Groundwater Availability, Table 1, page 24: The “probability of occurrence” for “interception of groundwater by mine workings” is “high (observed)” not “low”. This table entry must be revised to agree with the groundwater discussion presented elsewhere in the PHC.
- Groundwater Quality, Table 1, page 24: The quality of groundwater being discharged from the Crandall Canyon mine is degraded to the point that treatment is required; therefore. “Elevated dissolved solids and iron concentrations” must be added as a potential impact to groundwater quality with a probability of occurrence of “high (observed)”.
- Surface Water Quality, Table 1, page 24: An entry is required identifying “spilled or residual treatment chemicals” as a potential impact to surface water quality.
- Surface Water Quantity, Table 1, page 24: The permittee must revise this table entry or explain how mine discharge treatment to reduce iron concentrations is a mitigation measure for surface water quantity.

**R645-301-728.320** The discussion of toxic-forming materials in the 1st paragraph of the Acid-toxic Materials section (page 18) and Findings Section 728.320 must be revised. The elevated (greater than 1 mg/L) iron concentrations in the untreated mine water discharge are evidence that “toxic-forming materials” are present within the coal, overburden, or underburden at the Crandall Canyon mine. Iron present at elevated concentrations (e.g., greater than 1 mg/L) in water or precipitated on stream substrate is likely to be detrimental to biota or uses of the water.

**R645-301-728.330**, the Permittee must address the following deficiencies relating to potential impacts from coal mining and reclamation operations:

- The Permittee must either modify or support the findings that it is “unlikely” that “groundwater quantity or quality will be affected by the underground mining operation” (PHC Section 728.332) and why the “Crandall Canyon Mine is expected to have little impact on groundwater” (PHC Section 728.334). The explanation must consider that the mine discharges approximately 500 gallons per minute of intercepted groundwater which requires treatment due to its poor water quality.
- The permittee must address the impacts on the hydrologic balance of intercepting groundwater and discharging groundwater at approximately 500 gallons per minute.
- The permittee fails to address potential impacts on surface water quality from utilizing water treatment chemicals, either resulting from either spills of unused chemical products or from residual chemicals in the treated mine water effluent. The permittee must identify the specific chemicals being used to treat the water and the



**TECHNICAL MEMO**

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sampling and analytical methods used to monitor for residual treatment chemicals in the treated mine water discharge and/or the receiving water(s).

- In the section Mine Water Discharge (18th paragraph, page 16 and last paragraph, page 20), the Permittee must describe how monitoring the mine-water chemistry prior to treatment will support an evaluation of the effect of discharge of treated water to the receiving water (Crandall Canyon Creek). The Permittee must also describe procedures for monitoring the concentrations of residual water treatment chemicals being introduced to Crandall Canyon Creek.

**R645-301-120** The Permittee must address the following deficiencies to ensure the application contains current information which is clear and concise:

- Groundwater Interception, 4th paragraph, Page 3: Define the “northwest portion of the Crandall Canyon mine” and provide the date that the northwest portion of the mine was sealed.
- Groundwater Interception, 6th paragraph, Page 3 AND Mine Water Discharge, 3rd paragraph, page 12: Either provide a map showing the geometry of the mine after the 2007 collapse, or modify the statements to read “...based on the geometry of the Crandall Canyon Mine workings prior to the 2007 collapse...”
- Groundwater Interception, last paragraph, Page 6: Update the tense used in this paragraph and provide date(s) that the CVSSD culinary water treatment plant was constructed.
- Increased Sediment Loading, 2nd paragraph, page 11: The storage volume values provided for the discussion of the sediment pond do not agree with values provided in Appendix 7-4 Sediment and Drainage Control Plan, Table 11 Sediment Pond Design. Revise the text or Appendix 7-4 as appropriate.
- Mine Water Discharge, 16th paragraph, page 15: Define what is meant (including numeric values) by the phrase “elevated iron concentrations”, and define from what date Genwal is predicting these elevated iron concentrations to “not persist more than about 10 years” – e.g., from January 2011.
- Figure PHC-1: Correct the units shown for the y-axis of this figure, and add a footnote identifying that “Flow measurements prior to 3/19/2010 are not accurate” and identifying the date when the flow meter used for Outfall 002 was first suspected or known to be malfunctioning.
- PHC Attachment: No reference to this attachment is made in the text of Appendix 7-15; therefore, the Permittee should either remove this attachment or add explanations of the data presented in the attachment at appropriate sections of Appendix 7-15.